Recent Developments in the Biological Control of Weed Pests in Hawaii*

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In recent years the introduction of suitable insect enemies has accelerated the program of weed control, and, although this has been reported by Pemberton (1958), Fullaway (1958), Huffaker (1959), and Davis (1958–1961), it is desirable to report some of the outstanding developments that have taken place in this state-wide noxious weed program. Foremost is the incessant foliar devastation to lantana, *Lantana camara* var. *aculeata* (L.) Moldenke, caused by caterpillars of the introduced noctuid moth *Hypena strigata* F. (formerly known as *Hypena jussalis* Walker in Hawaii), the pyraustid *Syngamia haemorrhoidalis* Guenée, and the noctuid *Catabena esula* Druce.

Earlier attempts by Koebele and Perkins to control lantana biologically resulted in the establishment and wide distribution of eight out of 23 insects sent to Hawaii from Mexico by Koebele in 1902. However, in most cases these failed to exert sufficient stress to effectively control the plant.

In 1952 the Hawaii Board of Agriculture and Forestry (now State Department of Agriculture) resumed work on the introduction of lantana insects. N. L. H. Krauss began work in Cuba on this project in that year and has carried on investigations intermittently throughout tropical America and in other regions up to the present time. In 1953 the Fiji government, the Trust Territory of the Pacific Islands, the state of Queensland, and the Commonwealth of Australia joined the Board of Agriculture and Forestry in a cooperative project on lantana insects. John Mann, Entomologist of the Queensland Department of Public Lands, joined Krauss in Mexico and carried on investigations there from July 1953 to January 1954.

Among the potentially destructive lantana insects received from the exploratory team were the stem- and root-boring cerambycid *Plagiohammus spinipennis* Thomson and the branch-boring cerambycid *Aerenicopsis championi* Bates, both from the state of Vera Cruz, Mexico. The latter was approved for release in June 1955, but the host range tests of *P. spinipennis* were barely started when the supply of adult beetles became exhausted. This cerambycid was reintroduced in 1959 and this time the oviposition and feeding tests were completed in March 1960. The

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beetle was approved for release and liberated on Oahu and Hawaii. Other promising candidates such as *Blepharomastix acutangulalis* (Snellen) and *Octotoma scabripennis* Guerin from Mexico, *Teleonemia vanduzeei* Drake from Cuba, and *Diastema tigris* Guenée from the Panama Canal Zone, were received, tested, and released but are not known to be established.

Investigations continued and potent insects of lantana such as *Catabena esula* from southern California (1955), *Syngamia haemorrhoidalis* from Cuba and Florida (1956), and *Hypena strigata* from Kenya, East Africa (1957) were collected, and after satisfactorily completing appropriate starvation tests in the state quarantine facilities, Honolulu, were released throughout the state.

Never in the history of lantana in Hawaii has it been under such attack by introduced enemies as observed within the past four years. Beginning in 1957, caterpillars of the pyraustid *Syngamia haemorrhoidalis* denuded many acres of this range pest at Mokuleia, Oahu. Up to 1958 it was the only outstanding lepidopterous skeletonizer and defoliator of lantana. The depredation caused by this insect was followed by the establishment of another lepidopterous leaf feeder, *Hypena strigata*. Recovery of *Hypena* was somewhat slower but once underway, population "explosions" occurred at Lawai Valley, Kauai in late 1958 and in rapid order caused foliar devastation to thousands of acres of lantana throughout the state during 1959, 1960, and 1961. In most lantana areas it replaced *Syngamia* as the dominant control agent, building up astronomical populations during the winter months and leveling off during the summer months. During the latter months, the tingid *Teleonemia scrupulosa* Stål replaced *Hypena* and *Syngamia* in importance from sea level to approximately 2,500 ft. elevation.

In 1960, five years after its introduction from California, *C. esula* began to increase on Hawaii, Maui, and Oahu, and in 1961 showed promise of becoming an important control agent in some localities.

The impact of these recent introductions is beginning to have an effect on this aggressive range-weed pest in some localities. Dieback to ground level is a matter of record on Hawaii and lantana has been defoliated continuously over many hundreds of acres at Keokea, Maui, since January of 1961, despite heavy rains. Under such conditions, leaves that manage to appear temporarily on some plants are aborted and it appears that this is the prelude to dieback. On West Molokai, drought and heavy insect pressure (*Hypena*) killed many acres of lantana.

Next in order of importance with regard to recent developments is the biological control of the noxious range weed pest *Emex australis* Steinh., family Polygonaceae, at Makahalau and vicinity, Parker Ranch, Hawaii by the leaf-feeding and stem-boring weevil *Apion antiquum* Gyllenhal. This beetle was introduced by Krauss from Durban, South Africa in January 1957, and within three years reduced the weed infestation at Makahalau from a little over an acre to less than one-fourth of an acre. With premature killing of many plants, forage grasses quickly replaced *Emex*. Since weevils from these infested areas were collected and distributed to other *Emex* areas on Oahu and Maui, proper evaluation must be

deferred temporarily, but it is obvious that without environmental resistance, the potentialities of eradication of *Emex* by this beetle are most promising in many areas in the near future.

In 1959 *Acinia fucata* Fabricius, a tephritid which breeds in the flowerheads of sour bush, *Pluchea odorata* (L.) Cass. in Guatemala and Mexico, and *Trichotaphe aenigmatica* Gates Clarke, a leaf-feeding gelechiid sent by Krauss from Vera Cruz, Mexico, were recovered for the first time from this plant on Oahu. Sour bush, a fast growing composite shrub of statewide distribution, has no forage value. Since its introduction in 1959, *Acinia* quickly spread throughout Oahu and its seed-inhibiting potentialities are being studied. It was also liberated on Kauai and Maui and is well established on those islands.

Recoveries of introduced insects from two other range pests were made recently, but it is too early to appraise their effectiveness. The olethreutid moth, *Strepsicrates smithi* Walsingham, introduced from Florida and Georgia in 1955, was recovered from wax myrtle, *Myrica cerifera* L., in 1960. This insect also feeds on the noxious firebush, *Myrica faya* Ait. *Bocchoris fatualis* Munroe, a pyralid moth sent by Krauss from Paete, Laguna Province, Philippines, whose larvae feed on the foliage of *Melastoma malabathricum* L., was recovered and found established at Knudsen Gap, Kauai in 1959.

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